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(71) Applicant (for all designated States except US): UNI-VERSITY OF SOUTHAMPTON [GB/GB]; Highfield, Southampton SO17 1BJ (GB).

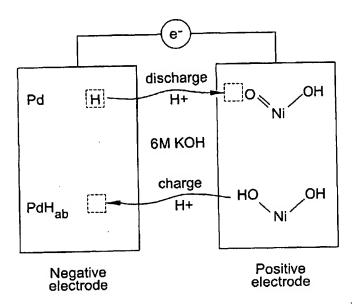
(72) Inventors; and

(75) Inventors/Applicants (for US only): BARTLETT, Philip, Nigel [GB/GB]; Amara, 11 Roseberry Road, Alresford S024 9HQ (GB). OWEN, John, Robert [GB/GB]; 3 Hanley Road, Southampton, Hampshire SO15 5AP (GB). NELSON, Phillip, A. [GB/GB]; 48 Queen Street, Henley-on-Thames RG9 1AP (GB).

- (74) Agent: TUBBY, David, George; Marks & Clerk, 57-60 Lincoln's Inn Fields, London WC2A 3LS (GB).
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[Continued on next page]

(54) Title: ELECTROCHEMICAL CELL



(57) Abstract: An electrochemical cell comprising a cathode, an anode and an electrolyte is provide, wherein: the cathode comprises mesoporous nickel having a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10-8 to 10-9 m; and the anode comprises a mesoporous material having a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10-8 to 10-9 m and selected from: carbon, cadmium, iron, a palladium/nickel alloy, an iron/titanium alloy, palladium or a mixed metal hydride.

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#### INTERNATIONAL SEARCH REPORT

national Application No T/GB 03/05441

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01M4/80 H01M4/66 H01M4/32H01M4/48 H01M4/04 C25D3/02 C25D3/16 According to International Patent Classification (IPC) or to both national classification and IPC B. FIELDS SEARCHED Minimum documentation searched (dassification system followed by dassification symbols) H01M C25D IPC 7 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, INSPEC, COMPENDEX, WPI Data C. DOCUMENTS CONSIDERED TO BE RELEVANT Relevant to claim No. Citation of document, with indication, where appropriate, of the relevant passages Category \* 1-11 EP 1 115 130 A (KANEBO LTD) Α 11 July 2001 (2001-07-11) paragraphs '0042!, '0043!; claims 1,13,14; figure 8; examples 1,5,6 1-11 NELSON P A ET AL: "MESOPOROUS Α NICKEL/NICKEL OXIDE ELECTRODES FOR HIGH POWER APPLICATIONS" JOURNAL OF NEW MATERIALS FOR ELECTROCHEMICAL SYSTEMS, ECOLE POLYTECHNIQUE DE MONTREAL, MONTREAL, CA, vol. 5, no. 1, January 2002 (2002-01), pages 63-65, XP001046009 ISSN: 1480-2422 cited in the application the whole document Patent family members are listed in annex. Further documents are listed in the continuation of box C. Special categories of cited documents : "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the "A" document defining the general state of the art which is not considered to be of particular relevance "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone \*E\* earlier document but published on or after the international filing date document which may throw doubts on priority claim(s) or which is clied to establish the publication date of another citation or other special reason (as specified) document of particutar relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such docu-O document referring to an oral disclosure, use, exhibition or ments, such combination being obvious to a person skilled other means in the art. document published prior to the international filing date but later than the priority date claimed \*&\* document member of the same patent family Date of mailing of the international search report Date of the actual completion of the international search 06/12/2004 19 November 2004 Authorized officer Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.

Lilimpakis, E

Fax: (+31-70) 340-3016

#### INTERNATIONAL SEARCH REPORT

ational Application No

		/GB 03/05441		
C.(Continua	ation) DOCUMENTS CONSIDERED TO BE RELEVANT			
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
<b>A</b>	NELSON P A ET AL: "MESOPOROUS NICKEL/NICKEL OXIDE-A NANOARCHITECTURED ELECTRODE" CHEMISTRY OF MATERIALS, AMERICAN CHEMICAL SOCIETY, WASHINGTON, US, vol. 14, no. 2, February 2002 (2002-02), pages 524-529, XP001163942 ISSN: 0897-4756 cited in the application the whole document	1-11		
Α	US 6 203 925 B1 (GOELTNER CHRISTINE ET AL) 20 March 2001 (2001-03-20) cited in the application column 4, line 32 - line 47 column 6, line 1 - line 6	1-11		
A	WO 01/89991 A (VIABLE KOREA CO LTD; OH SEUNG MO (KR); YOON SONG HUN (KR); FINECELL C) 29 November 2001 (2001-11-29) the whole document	1-11		
<b>A</b>	WO 99/00536 A (ATTARD GEORGE SIMON; BARTLETT PHILIP NIGEL (GB); ELLIOTT JOANNE (GB);) 7 January 1999 (1999-01-07) cited in the application claims 1-4; examples 1-12	1-11		
A	EP 1 244 168 A (FRANCOIS SUGNAUX) 25 September 2002 (2002-09-25) abstract	1-18		
Α	G.S. ATTARD ET AL: "Mesoporous Pt/Ru Alloy from the Hexagonal Lyotropic Liquid Crystalline Phase of a Nonionic Surfactant" CHEM.MATERIAL, 27 April 2001 (2001-04-27), pages 1444-1446, XP002306570 the whole document	1-18		

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

#### INTERNATIONAL SEARCH REPORT

Information on patent family members

...T/GB 03/05441

				1 517 4	
Patent document cited in search report	Publication date		Patent family member(s)		Publication date
EP 1115130	A	11-07-2001	EP	1115130 A1	11-07-2001
L. 1110100	••		ÜS	6631073 B1	07-10-2003
			CN	1315046 Ť	26-09-2001
			WO	0011688 A1	02-03-2000
US 6203925	B1	20-03-2001	AU	743153 B2	17-01-2002
			ΑU	6303498 A	18-09-1998
		•	CA	2282528 A1	03-09-1998
			EP	0963266 A1	15-12-1999
			WO	9837997 A2	03-09-1998
			JP	2001513147 T	28-08-2001 
WO 0189991	A	29-11-2001	KR	2002031447 A	02-05-2002
			CN	1452592 T	29-10-2003
	•		EP	1292534 A1	19-03-2003
			JP	2004503456 T	05-02-2004
			WO	0189991 A1	29-11-2001
			US	2004047798 A1	11-03-2004
W0.9900536	Α	07-01-1999	AT	222301 T	15-08-2002
WO:3340000			AU	733930 B2	31-05-2001
			AU	8225098 A	19-01-1999
			CA	2295223 A1	07-01-1999
			DE	69807230 D1	19-09-2002
			DE	.69807230 T2	17-04-2003
			EP	0993512 A1	19-04-2000
			WO	9900536 A2	07-01-1999
			HK	1026236 A1	03-01-2003
			JР	2002506485 T	26-02-2002
			US	6503382 B1	07-01-2003
EP 1244168	Α	25-09-2002	EP	1244168 A1	25-09-2002
L1 15-7-1200			CA	2441125 A1	26-09-2002
			WO	02075826 A2	26-09-2002
			EP	1374325 A2	02-01-2004
			US	2004131934 A1	08-07-2004